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No. 51

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No. 51

This semimonthly serial publication consists of materials gathered from recent publications of the Sino-Soviet Bloc countries, presented in the form of abstracts, summaries and occasional full translations of articles on the subjects reflected in the table of contents. Complete bibliographic information accompanies each article.

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I. ASTRONOMY

News

Interview at Pulkovo Observatory

In an interview with Academician A. A. Mikhaylov, Director of the Pulkovo Observatory, and Prof. V. A. Krat, Deputy Director, the author of the article cited below developed a rather limited amount of information concerning the Soviet Solar Service. The Solar Service Center collects data from all observatories of the Soviet Union and other Socialist countries. These data are used by the Solar Commission of the Academy of Sciences and the Pulkovo Observatory to compile daily solar maps. These maps show the size and position of sunspots and other active features.

At the Thirteenth International Astronautical Congress at Warsaw A. B. Severnyy, Chairman of the Solar Commission, reported that certain phenomena have been found which characteristically precede solar flares.
(Abstract: "Telescopes Look Upward," by S. Nutsubidze; Tbilisi, Zarya Vostoka, 24 October 1962, p. 4)

Activity at Kislovodsk Mountain Observatory

A group of Pulkovo astronomers at the Kislovodsk Mountain Astronomical Station of the Academy of Sciences has begun regular lunar and stellar observations. The leader of this team is Candidate of Physical and Mathematical Sciences Kh. I. Potter. He reports that a Pulkovo-constructed mobile lunar astrograph is being used in this work. Almost 300 lunar photographs have been taken; these photos have been sent to the Pulkovo Observatory for careful measurement and processing with the assistance of electronic computers.
(Abstract: "Three Hundred Photographs of the Moon," unsigned; Moscow, Komsomol'skaya Pravda, 24 October 1962, p.4)

The Ussuri Solar Station

The Ussuri Solar Station, situated in the Primor'ye Kray, is the most easterly of the Soviet Solar Service stations. Active solar

processes are studied daily. The station is equipped with new instruments. N. Osipenko, mechanic of the solar observatory, is installing a horizontal solar telescope to be used for study of the spectrum of active formations on the sun -- sunspots, chromospheric flares and prominences.
(Complete translation: "Through Our Own Country," unsigned; Moscow, Trud, 15 November 1962, p. 3)

Soviet Astronomer Detects Oxygen on Venus

Professor Vladimir Konstantinovich Prokof'yev of the Crimean Astrophysical Observatory reported to an international conference of astronomers at Liege in July 1962 that he had detected weak traces of oxygen in the Venerian atmosphere, apparently at 30 km above the planet's surface. The photo plates with the atmospheric spectrum had been exposed 1½ hours and processed about a month. Great difficulties were caused because the Venerian oxygen line coincides with the corresponding line for the earth's atmosphere. Prokof'yev made his observations in the morning and evening and at different seasons; the Venerian line "moved out" from behind the obscuring line. Prokof'yev concedes the possibility that the oxygen is a product of plants but considers it probable that it is solar-induced due to detachment of molecules of CO_2.
(Abstract: "Oxygen on Venus", by L. Repin, Crimean Astrophysical Observatory; Moscow, Komsomol'skaya Pravda, 17 November 1962, p. 4)

A General Discussion of the Solar Photosphere

The most recently received issue of the journal Priroda carries an authoritative description of the solar photosphere. The general discussion is broken down into: granulation; waves in the photosphere; and solar magnetic fields. Certain specific Soviet research is mentioned.

Pulkovo observations with a photoelectric photometer in 1960 revealed that the solar disk brightness has wavelike variation. The greater the length of the "wave" the brighter it is. It may be that the granulation is due to waves in the photosphere. The Azerbaydzhan astronomer M. Kerimbekov has used a movie camera (24 to 50 frames/sec) for photographing the granules. The camera was installed in the Pulkovo solar telescope (solar image of 60 cm). He used this method before it was used at Pic-du-Midi. Kerimbekov determined the tangential velocities of the granules; they were of the same order as radial velocities, as would be expected from the wave theory. However, long-lived granules do not show any tangential movements. Soviet astronomers have a magnetograph of better parameters than the Babcock instrument; it is in use at Pulkovo and in the Crimea. It can be used to simultaneously measure the magnetic field of spots and determine radial velocity. Weak magnetic fields are present everywhere on the

sun. Near spot groups they attain tens of oersteds, elsewhere only a few oersteds. There is no unified magnetic field. In the photosphere regions of southern polarity alternate with those of northern polarity.
(Abstract: "The Solar Photosphere", by Prof. V. A. Krat, Main Astronomical Observatory; Moscow, Priroda, No. 11, 1962, pp. 41-46)

Polarization of Cygnus A

The polarization of the radio emission of Cygnus A is discussed, with the source being the American publication Astrophysical Journal. The author points out that this radio source consists of two radio-emitting sources, relatively far apart. With a large instrument, such as the large radio telescope of the Main Astronomical Observatory, it will be possible to measure the polarization of both regions separately. There is reason to believe that these regions are polarized more strongly, but the predominant orientations of the electric vectors are different in each region. It is very important to determine these directions and compare them with the configurations of the radio-emitting regions and the optically visible object.
(Abstract: "Polarization of the Radio Galaxy Cygnus A", by V. I. Slysh; Moscow, Priroda, No. 11, 1962, pp. 106-107)

Globe of Mars at Moscow Planetarium

A new exhibit at the Moscow Planetarium is a huge globe of Mars prepared on the basis of observations of that planet at the time of the great opposition of 1956. The work was directed by V. A. Bronshten, scientific consultant of the Moscow Planetarium.
(Abstract: "The First Globe of Mars", by B. Maksimachev, Moscow Planetarium; Moscow, Vechernyaya Moskva, 24 November 1962, p. 4)

Martian Map Published

The All-Union Astronomical-Geodetic Society has recently published a map of Mars. The position of features was apparently determined from photographs. An effort was made to determine areographic coordinates precisely in order that changes in the outlines of the seas and continents can be determined from later photographs. No information is given concerning the scale of the map or its other characteristics.
(Abstract: "Map of Mars", by Boris Pshenichner, Active Member, All-Union Astronomical-Geodetic Society; Minsk, Sovetskaya Belorussiya, 14 November 1962, p. 4)

Pulkovo Astronomical Conference

A conference of astronomers has been concluded at Pulkovo after a six-day session. It was attended by representatives of the Social-

ist countries and dealt with problems involved in photographic observations of artifical earth satellites.
(Complete translation: "By Telephone and Telegraph", unsigned; Moscow, Sovetskaya Rossiya, 27 November 1962, p. 4)

Kazakh Astronomer Discusses Astrobotany

A pupil and associate of the late Prof. G. A. Tikhov, Anna Prokop'yeva Kutyrev, has continued his work in the field of astrobotany. She contents that life has developed in all reaches of the universe in accordance with a single unified pattern. Kutyrev disagrees with radioastronomers who believe that the surface temperature of Venus is 300°; she thinks it varies between 60 and 90°. Life is therefore possible, and in rather complex vegetative forms.

She has continued Tikhov's method of studying vegetation in inhospitable areas of the earth and in the Pamirs, for example, has discovered a plant with yellowish leaves. A similar plant has been found in the Kyzlkum, where the temperature -- 80° -- is similar to that of Venus. Plants with a similar leaf color were found in Uzbekistan this year. Kutyrev states that spectral analysis of the surface of Venus, carried out on those rare occasions when there is a gap in the cloud deck, reveal that its vegetation is yellowish in color. It may be assumed that the Venerian climate is the same now as it was on the earth and Mars hundreds of millions of years ago. She also believes that life in its simplest forms (that is, life without oxygen) is also possible on Mercury, Jupiter and Saturn.
(Abstract: "Mysteries of the Planet of Storms", by M. Fel'd; Alma-Ata, Kazakhstanskaya Pravda, 14 October 1962, p. 4)

Visit to Soviet Optical Plant Described

The author of the article cited below describes a visit to the optical plant (unnamed) which produced the glass disk for the 2.6-m Shayn telescope at the Crimean Astrophysical Observatory.

Quartz is received in carload lots from Karelia; after processing it can be crumbled in the hand and after purification is reduced to a powder. The various stages of the glass-making process are described, as are the parameters of the glass being produced.
(Abstract: "Eye Into the Universe", by Iv. Frolov; Moscow, Sovetskaya Rossiya, 1 August 1962, p. 4)

Star Catalog

A brief item in Izvestiya reveals that workers at the Nikolayev Observatory are undertaking the compilation of a catalog of star positions. Actual testing of an electro-mechanical device by which the time of star transit across the meridian is automatically determined has already been completed at the observatory.

(Complete translation: "Catalog of Star Positions", unsigned; Moscow, Izvestiya, 1 December 1962, p. 4)

Abstracts of Scientific Articles

A Method for Determination of Absolute Natural Stellar Motions

The article cited below presents a method for determination of the absolute natural motions of stars and the reduction of relative natural motions to absolute motions for 19 galaxies in 8 areas of the sky.
(Abstract: "Determination of the Absolute Natural Motions of Stars"; author not cited; Tashkent, Izvestiya Akademii Nauk UzSSR, Seriya Fiziko-Matematicheskikh Nauk, No. 5, 1962, pp. 77-84)

Solar Radio Emission at 23.5 Centimeters

According to a Russian-language abstract, an article by I. N. Burak, titled "On the Distribution of the Intensity of the Radio Emission of the Solar Disk and its Dimensions at a Wavelength of 23.5 Centimeters" (Trudy Voronezhskogo Universiteta /Proceedings of Voronezh University/, Vol. 55, 1961, pp. 39-47), gives a brief account of the well-known theory of the intensity of solar emission. For a period of six months, the intensity of solar emission was measured by monitoring its transit through the directivity pattern of an antenna, the measurements being made by modulation and compensation methods. It was found that the solar temperature at a wavelength of 23.5 centimeters fluctuates between 10^5 and $1.5 \cdot 10^5$ degrees Kelvin. Measurements of the dimensions of the sun, taken with a marine interferometer, showed that the uniformly emitting disk of the sun at this wavelength has a diameter of 37'8. It was concluded that the radio-emitting portion of the sun represents a disk with the most intensive radio emission at the edge.

A brief description and block diagram are given of the receiving equipment. (Referativnyy Zhurnal - Avtomatika i Radioelektronika, No. 9, 1962, Abstract No. 9 Zh 230)

II. METEOROLOGY

News

Climatic Map of Kirgizia

A group of climatologists in the Geography Division of the Academy of Sciences of the Kirgiz SSR has prepared a series of 12 climatic maps; the work was done under the direction of Candidate of Geographical Sciences Z. A. Ryazanteva. The maps show the temperature regime for the republic on the basis of data prior to 1957. Special graphs show temperature conditions at different elevations. The maps can be used for selecting the most suitable agricultural crops and varieties for each zone, planning dates for field work and the grazing of animals, etc.
(Abstract: "Climatic Maps of Kirgizia", unsigned; Moscow, Vestnik Academii Nauk SSSR, No. 11, 1962, p. 98)

Problems of Climate Modification

A scientific conference on the philosophical problems of present-day natural science was held on 17 May.

A number of reports dealt with climate modification; B. L. Dzerdzeyevskiy, Institute of Geography, warned that favorable modification at one place may be accompanied by unfavorable changes elsewhere. Several reports advocated climate modification by control of ocean currents.

A. M. Obukhov, Institute of Physics of the Atmosphere, noted that the instability of atmospheric processes makes forecasting difficult but that these processes can be controlled with a relatively small expenditure of energy. A. M. Yaglom, of the same organization, discussed the great theoretical and practical value of modeling atmospheric processes and employing mathematical statistics and the theory of probabilities. Either mathematical or physical modeling can be used in the experimental study of meteorological processes.

The article discusses the methodological problems involved in study of the earth sciences as a whole, rather than meteorology alone.
(Abstract: "Methodological Problems in the Development of the Earth Sciences and the Modification of Natural Conditions", by A. G. Doskach; Moscow, Vestnik Akademii Nauk SSSR, No. 11, 1962, pp. 138-140)

Conference on Climate Modification

A special council on the problem of modification of meteorological processes has been established under the State Committee on the Coordination of Scientific Research Work of the Soviet Council of Ministers. This problem was discussed at a conference held in Leningrad during the period 11-13 June. The organizations represented were the Main Geophysical Observatory and the Institutes of Geography, Physics of the Atmosphere and Applied Geophysics. Sixteen reports were presented.

M. Ye. Berlyand discussed the problem of protection of plants against frost; effective means have been developed to protect plants and these must be put into use. N. K. Klyukin considered the problem of modifying climate by artificially eliminating or protecting the snow cover. D. L. Laykhtman reported on change of meteorological conditions by modification of the radiation regime. M. I. Yudin cited computations showing that an air mass could be affected appreciably by about 2,000 helicopters which would create a powerful descending air current.

An entire series of reports dealt with modification of climate of the Northern Hemisphere by changing or eliminating the ice cover of the Arctic Basin. Budyko's group at the Main Geophysical Observatory covered the same ground it has covered many times before; the final effects of modification of the Arctic ice remain unclear and the practical methods for bringing about these changes are equally unclear.

N. I. Vul'fson and A. V. Kondratovaya reported on the results of a study of the relationship between the variable aridity of southeastern European USSR and circulation in North Africa. M. P. Timofeyev discussed the influence of reservoirs on microclimate.

A. M. Gusev stated that studies of climate modification are impaired by the absence of a theory of climate for the entire planet; his development of a physical model of climate is hindered for the same reason.

(Abstract: "Problems in the Modification of Meteorological Processes", by A. M. Gusev; Moscow, Vestnik Akademii Nauk SSSR, No. 11, 1962, pp. 135-136)

Current Status and Problems of Meteorological Science

The Director of the Central Institute of Forecasts points out that weather data for the Southern Hemisphere, the ocean areas and equatorial regions is very scarce; no more than 50% of the needed data are available. Only 20% of the entire atmosphere is now being investigated with modern instruments. The planetary distribution of the energy flux absorbed and radiated by the earth-atmosphere system is still unknown and only a real knowledge of planetary energy resources will permit elaboration of a correct and full theory of weather and climate. Meteorological satellites are urgently needed. World centers

for the collection and dissemination of such data are required, as well as numerous regional centers, all equipped with high-speed computers.

Meteorological satellites with polar orbits will be able to view the entire earth -- every point twice each day; such a satellite should orbit at a height of about 5,000 km. The best system would employ six satellites with a period of four hours at a height of 6,000 km. Still, a chart based on such data would be of inadequate scale to show squall lines and many similar details; this supplementary information could be supplied by satellites orbiting at heights of several hundred kilometers. Tropical countries must have their own satellites in equatorial orbits. For example, satellites at a height of 1,000 km and with a period of 105 minutes could observe the earth's surface from 30°N to 30°S.

(Abstract: "What Will be the Weather Tomorrow, Comrade Space?", by Prof. V. A. Bugayev, Director, Central Institute of Forecasts; Moscow, Znaniye-Sila, No. 9, 1962, pp. 25-26)

Meteorological Work in Tadzhikistan

"In the not distant future" the Hydrometeorological Service of the Tadzhik SSR will be in a position to better cope with meteorological and hydrological problems. For example, if word is received of a drop in the water level of the Vakhsh River, which would threaten the irrigated cotton crop, electronic computers will be used to assess the situation. Weather modification teams will be alerted. Meteorological rockets fired into dense clouds over the Fedchenko Glacier will quickly clear the sky, melting thereby will be accelerated and the river will be replenished. To ensure water supplies the meteorologists also will induce snowfalls at selected points during the winter. The realization of such a scheme is in the hands of the Laboratory of Atmospheric Physics and Hydrology of the Tadzhik Academy of Sciences; its main task is the problem of regulating the runoff of mountain rivers. Director of the Laboratory is Candidate of Technical Sciences S. M. Gordon. Other tasks include hail prevention and prevention of heavy damaging downpours.

(Abstract: "Weather on Order", unsigned; Dushanbe, Kommunist Tadzhikistana, 21 October 1962, p. 3)

Exceptional Forecasting Method Claimed

The following is the full text of a brief item in the Moscow press:

"Ninety percent of all storms can be predicted if forecasters use a method proposed by Doctor of Mathematical Sciences V. I. Gubin. That scientist has determined mathematical functions and derived a formula for the computation of the force, direction and time of development of winds in a particular area twelve hours in advance. The Uzbek Administration of the Hydrometeorological Service is already using the

Gubin method for prediction of storms on the Aral Sea. (Complete translation: "This is Interesting to Know"; Moscow, Trud, 15 November 1962, p. 3)

Use of Computers for Numerical Prediction of Winds

According to a Russian-language abstract, the article by A. I. Romov, titled "Numerical Forecasting of the Wind in the Free Atmosphere With the Use of Electronic Digital Computers," (Materialy Soveshchaniya Koordinatsionnoy Komissii po Chislitel'nym Metodam Prognoza /Materials of the Conference of the Joint Commission on Numerical Methods of Forecasting - a collection of articles/, Leningrad, 1961, pp. 71-87), points out that experience in the numerical prediction of barometric pressure has shown that methods which make use of vortex equations always involve certain systematic errors, and that certain modifications of the equation of horizontal motion must be made in the interest of accuracy. The initial system of equations for the numerical prediction of the wind is made up of two equations of motion for the horizontal axes of the coordinates, an equation of thermal influx in quasi-static approximation, and continuity equations described by spherical coordinates in barotopographic form. Contrary to the usual procedure in forecasting, the problem is posed here in a form in which the geopotential does not enter into the prognostic relationships, and the horizontal components of flow velocity serve as the intial functions. The hypothesis of quasi-geostrophicity in the usual form is not used to derive the prognostic equations. The solution requires data on wind soundings in order that the initial fields of the wind velocity components can be plotted. These fields should be given in such a way that both the elimination of disturbing small-scale motions and preservation of actual, large-scale (synoptically important) motions be guaranteed. A method of numerical prediction of the wind is given for an intermediate level. Different prognoses were made using the Ural and Kiev computers. The daily forecast was shown to be satisfactorily accurate. (Referativnyy Zhurnal - Avtomatika i Radioelektronika, No. 9, 1962, 9-1-142 ye)

Study of Breeze-Circulation in Lake Sevan Basin

The study of the wind regime of water reservoirs and lakes is of value from both a cognitive as well as a practical viewpoint. This arises from the necessity of developing methods for computing local atmospheric processes in forecasting the weather and its separate elements. The study of local winds also involves the solution of a number of applied problems, among which is that of determining the amount of evaporation from water surfaces. The effectiveness of measures (monomolecular films) employed for curtailing the amount of evaporation from reservoir and lake surfaces depends on the wind regime over these bodies, especially in mountain areas. Here, the general wind pattern,

determined by overall circulation processes, is complicated by local winds--breezes, mountain-valley and foehn winds. These play a decisive role in the selection of practical methods of covering the water surface, the method of its application, and in the type of matter used, the frequency of application, etc.

The article cited below considers only the breeze circulation arising as a result of temperature differences in the underlying surface and having a diurnal pattern. On these assumptions, a comparatively simple theoretical model within the limits of the linear theory is obtained. Equations are derived for the solution of the problem. Three solutions are given. A solution not considering the Coriolis force and a steady coefficient of turbulent mixing; a solution taking into consideration the Coriolis force with a steady coefficient of turbulent mixing; and a solution not considering the Coriolis force and a variable coefficient of turbulent mixing.

Another report is planned in which specific examples will be considered and an anlysis of results given.

(Abstrct: "Breezes in the Lake Sevan Basin and Some Results of Their Computation Based on the Actual Distribution of Temperatures of the Underlying Surfaces," by A. M. Mkhitaryan; Yerevan, Izvestiya Akademii Nauk Armyanskoy SSR, Seriya Tekhnicheskikh Nauk, Vol. XV, No. 5, 1962, pp. 15-32)

III. OCEANOGRAPHY

News

"Kooperatsiya" to Leave for Unspecified Destination

The "Kooperatsiya" returned from Antarctica on 26 March. This was followed by a voyage to the North Pole; on this voyage great difficulty was encountered with the ice in the Laptev Sea. The vessel is loaded and ready for departure to an unspecified destination.
(Abstract: "The 'Kooperatsiya' About to Sail on New Voyage", unsigned; Riga, Sovetskaya Latviya, 22 November 1962, p. 4)

Map of Submarine Topography of the Arctic Ocean

The world's first map of submarine topography of the Arctic Ocean has now been published in the monograph Osadki Severnogo Ledovitogo Okeana (Sediments of the Arctic Ocean). The authors are N. A. Belov and N. N. Lapina and the publisher is the Arctic and Antarctic Institute and the Institute of Arctic Geology.

The basic elements of this topography are the Soviet-discovered Lomonosov and Mendeleyev Ranges whose elevation exceeds three kilometers. The map is said to be of practical value for fishing operations beyond the Arctic Circle.
(Abstract: "Submarine Geography", unsigned; Leningrad, Leningradskaya Pravda, 14 November 1962, p. 4)

IV. TERRESTRIAL GEOPHYSICS

News

Program of Institute of Geology and Geophysics

The Institute of Geology and Geophysics of the Siberian Division of the Academy of Sciences was organized in 1957. It is working on a wide range of scientific problems associated with the geological structure of Siberia and its deposits of petroleum, gas, coal, bauxite and other minerals. Experimental work is being done in the fields of mineralogy, petrography, tectonics and the geophysical study of the earth's crust and upper mantle. The Institute organizes and coordinates work in geology, geophysics and geography which is carried out by other institutes of the Siberian Division at Irkutsk, Yakutsk, Krasnoyarsk, Ulan-Ude, Chita, Vladivostok and Magadan and on Sakhalin and Kamchatka.
(Abstract: "The Institute of Geology and Geophysics", unsigned; Novosibirsk, Geologiya i Geofizika, No. 10, 1962, p. 1)

Conference on Seismology

An article appearing in a Dushanbe newspaper reports on a five-day conference on seismology held recently in that city. Problems of earthquake-resistant construction and engineering seismology also were discussed, as were problems of structure of the earth's crust. Ninety reports were presented at six symposia; sixty-six scientific institutions were represented.

A. A. Musaelyan of the Tadzhik Institute of Earthquake-Resistant Construction and Seismology reported on the geological engineering conditions for seismic microregionalization of Dushanbe. The same Institute is studying the seismic resistance of buildings by earthquake modeling. New methods have been developed for the rapid and economical solution of complex problems of computing the seismic resistance of structures. The Institute's Director, V. N. Gayskiy, reported on the work of the Tadzhik Complex Seismological Expedition of the Academy of Sciences, USSR, and the Academy of Sciences of the Tadzhik SSR. The methods developed by the expedition have been used in the seismic zoning of the Vakhsh River basin; the work was done in connection with plans for a major hydroelectric power development. It was found that

earthquake foci coincide with fault zones. In that area several new stations were established and equipped with highly sensitive apparatus. The next such conference will be held at Frunze in 1963.
(Abstract: "Problems in Seismology", unsigned; Dushanbe, Kommunist Tadzhikistana, 23 October 1962, p. 3)

Conference on Superdeep Drilling

A technical conference on superdeep drilling was held late in 1961 under the sponsorship of the Scientific-Technical Society of the Petroleum and Gas Industry and the Institute for the Development of Petroleum and Gas Deposits of the Azerbaydzhan Academy of Sciences (Director, Academician S. M. Kuliyev).

In 1961 the mean depth of the holes drilled in the USSR was 4,750 m, 200 to 250 m greater than the mean depth of holes in the United States.

The drilling of a hole exceeding 5 km in depth was discussed. Turbodrilling is now being used more extensively since drilling pipe of higher quality is available. A rig for reaching depths of 7,000 m is being developed. A superdeep well (10,000-15,000 m) is planned for the Saatlinskiy Rayon in the Azerbaydzhan SSR.
(Abstract: "At the Technical Conference on Superdeep Drilling", by M. Gol'd; Baku, Izvestiya VUZ, Neft' i Gaz, No. 12, 1961, p. 72)

New Method and Apparatus Developed for Wave Study

The Institute of Physics of the Earth has developed a new portable apparatus in its Laboratory of Seismic modeling which can be used in mines and laboratories for study of the propagation of supersonic waves in rocks and a new method has been devised for study of rock pressure in mines.
(Abstract: "New Apparatus Developed", unsigned; Moscow, Moskovskaya Pravda, 20 October 1962, p. 1)

Latest Soviet Drilling Rigs Described

In a few years the drilling of 4- to 5-km deep holes will be common practice in Azerbaydzhan. Drilling to depths of 3,000 to 5,000 m is accomplished with the rigs "Uralmash-3D" and "Uralmash-4E" with diesel or electric drive. They were designed in 1950-1951. Ten years of use has shown that the Ural rigs are effective for drilling to about 3,500 m. The Institute "Giproneftemash" have therefore developed the "BU-200" rig with a load-lifting capacity of 200 tons for drilling 5-km deep holes. The "BU-200" has a power drive consisting of several diesel units. The tool can now be raised more rapidly and mud pressure is increased; diesels are mounted on a concrete base; there is an A-shaped tower (the article supplies much additional technical data concerning the components). Many improvements have been introduced in

the field. Many serious difficulties have been experienced in breakdowns and no replacement parts have been available. Despite the importance of the project all requests for replacement parts have been ignored by the factory. Drilling of 5-km holes with the "3D" and "4E" is technically and economically unjustified.
(Abstract: "New Rig for Deep Drilling", by G. Sklovskiy, Chief, Division of Research and Design of Drilling Equipment of the Institute "Giproneftemash"; Baku, Bakinskiy Rabochiy, 11 November 1962, p. 2)

Earthquake Felt at Kishinev

An earthquake awoke residents of Kishinev on the morning of 9 November. The shocks were repeated two or three times. The seismic station of the Academy of Sciences of the Moldavian SSR recorded a shock of intensity 3 or 4. The epicenter was situated in the Carpathians approximately 200 km from Kishinev. Such phenomena are no rarety in Moldaviya although none have caused serious damage.
(Abstract: "Earthquake in Moldaviya", unsigned; Kishinev, Sovetskaya Moldaviya, 10 November 1962, p. 4)

Institute of Volcanology Established

An Institute of Volcanology has been established at Petropavlovsk-na-Kamchatke on the basis of the Kamchatkan Geological and Geophysical Observatory and the Laboratory of Volcanology. It will unite the efforts of scientific institutes in the USSR engaged in the study of present-day vulcanism. Attention will be centered on the Kurile-Kamchatkan zone and to those products of volcanic eruptions which can be used as construction material. Post-volcanic and hydrothermal processes and their products will also be studied. Other problems to be investigated include: the use of volcanic heat in the national economy; submarine vulcanism and submarine furmorale activity; methods of predicting volcanic eruptions; mapping of volcanically dangerous zones; and development of active and passive methods of protection from volcanic eruptions.

The Institute will have ten laboratories, two volcanological stations (Kamchatskaya and Avachinskaya), the Kamchatkan Complex Expedition, the Petropavlovsk-Kamchatskaya Ionospheric Station and a museum.
(Abstract: "Concerning Institutes of the Siberian Division", unsigned; Moscow, Vestnik Akademii Nauk SSSR, No. 11, 1962, p. 128)

Review of Geophysical Research in Siberia and the Far East

The present-day status of geophysical research in Siberia and the Far East is described and the area covered by various types of studies have been plotted (map, p. 86). A bibliography of 27 items lists the most important sources which support the text and map.

Emphasis in this area is on exploration for mineral resources; there has been little deep seismic sounding. The first half of the article discusses current status and past work; the second half is devoted to future plans. Specific methods and combinations of methods are recommended for particular areas. Unfortunately, the author merely gives several pages of recommendations without any indication of whether they have been authorized or whether existing or planned organizations have the capability to implement the program.
(Abstract: "Current Status, Tasks and Prospects of Geophysical Research in Siberia and the Far East", by E. E. Fotiadi, Institute of Geology and Geophysics, Siberian Division, AN SSSR; Novosibirsk, Geologiya i Geofizika, No. 10, 1962, pp. 83-92)

Abstracts of Scientific Articles

Abstracts of Articles in "Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya", No. 11, 1962

1. "Change of the Elastic Properties and Density of Matter at the Boundary of the Earth's Core", by L. M. Balakina and A. V. Vvedenskaya, Institute of Physics of the Earth, pp. 1457-1470.

Observations of first displacements in waves reflected from the earth's core and use of the theory of wave propagation in a layered elastic-viscous medium has led to the conclusion that when there are small and brief (of the order of seconds) deformations arising during the propagation of elastic waves the mechanical properties of the core at its outer boundary, like the properties of the mantle, are close to the parameters of an elastic body. Changes in the density of the medium and the velocity of propagation of transverse waves on this boundary are equal to $\rho_1/\rho_2 = 0.55$ and $b_1/b_2 = 10.6$.

2. "The Deep Structure of the Earth's Crust in the Trans-Carpathians", by A. A. Borisov and G. I. Kruglyakova, L'vov Branch, Institute of Geophysics, Ukrainian Academy of Sciences, pp. 1497-1501.

This article presents an analysis of the reasons for the noncoincidence of magnetic and gravitational anomalies in the Trans-Carpathians. An estimate is made of the thickness of the earth's crust and it is postulated that the "granite" layer has assumed "basaltic" properties. The authors cite one of the possible variants for interpreting the reverse magnetic polarity of rhyolite domes. It was found that the gravitational anomalies in this region for the most part reflect the nonhomogeneity of the structure of the crystalline complexes of the earth's crust, and in part, possibly, the anisotropy of the subcrustal substratum. The magnetic anomalies, and in part the local gravitational anomalies, are due to the distribution of magmatic formations, predominantly in the sedimentary, primarily Neogene complex.

3. "Dependence of the Surface Wave Spectrum on the Depth of a Source Within the Limits of the Earth's Crust", by V. I. Keylis-Borok and T. B. Yanovskaya, Institute of Physics of the Earth, pp. 1532-1539.

The results of this study make it possible to define a method for classifying crustal earthquakes into two groups: with the depth of the focus h greater and less than H/4-H/2. It is first necessary to make a mass determination of the Rayleigh waves for crustal earthquakes and attempt to determine "standard" spectra for those few cases when h is known. The estimate of h is then simply reduced to a comparison of the Rayleigh wave spectrum for the earthquake being studied and the mean or "standard" spectra. It is necessary to take into account the dependence of the spectrum on earthquake energy, epicentral distance, local conditions, etc. Until this dependence has been studied it will be difficult to determine the statistical or standard spectra.

4. "A Discussion of a Certain Time Dependence of the Anomalous Course of Tilting of the Earth's Surface on the Time of Earthquake Occurrence", by R. M. Karmaleyeva, Institute of Physics of the Earth, pp. 1557-1561.

This article considers cases of the anomalous course of tilting of the earth's surface before certain earthquakes as revealed by the data for an 11-year series of observations made by the seismic station at Dushanbe. The statistical method was used for comparing the peculiarities of the course of tilting and relative change in seismic activity. The author considers peculiarities in the behavior of tilting and relative change in seismic activity. The author considers peculiarities in the behavior of tilting during the several days preceding earthquakes with epicenters within a radius of 100 km from Dushanbe.

5. "Experience in the Use of Magnetic Recording of Variations of the Earth's Variable Magnetic Field", by M. V. Kolmakov, Institute of Physics of the Earth, pp. 1605-1613.

This article describes an attempt to use a magnetically modulated detector and magnetic recording for registry of the earth's variable magnetic field in the 0-50 cps range. Amplitude modulation was employed. The carrier frequency (1000 cps), after some limiting and amplification, was recorded with an ordinary single-channel sound recorder. It is shown that in combination with a pen recorder this very simple form of magnetic recording of variations has many advantages. A block diagram is shown in Fig. 1 and a circuit diagram in Fig. 2; the instrument is fully described textually.

6. "The Possibility of Expanding the Frequency Range of a Magnetic High-Frequency Microvariation Set", by Yu. M. Yegorov, Institute of Physics of the Earth, pp. 1659-1662.

This is the first published description of an improved set to be used for study of short-period pulsations of the earth's magnetic field. Expansion of the set's passband by using a feedback is of no advantage when recording variations of the earth's geomagnetic field because of the high level of instrument noise. Sets of this type can be used for recording magnetic field variations with an amplitude of the order of a half-gamma or more. Expansion of the band by lowering the sensitivity of the detectors and using electromagnetic damping makes it possible to obtain a set passband of the order of 5 cps. In this case the principal difficulties involve elimination of transverse oscillations of the system. Hereafter it will apparently be necessary to employ liquid damping of the detectors for expansion of the passband.

7. "The Use of Elastic Waves of Industrial Explosions for Sounding of the Earth's Crust in the Urals", by N. I. Khalevin and F. F. Yunusov, Institute of Geophysics, Ural Branch, Academy of Sciences, pp. 1567-1573.

Elastic waves from industrial explosions were recorded in the Nizhniy-Tagil synclinorium in the Urals by using an SS-24-P seismic set for distances from 7.5 to 50 km. Intense oscillations were recorded for intervals of 6 to 10 sec. These oscillations were dominant at various shot points and recording stations. It is clear that the use of seismic investigations with elastic waves is a promising method for the study of the deep structure of the Urals. Work in this direction should continue and be combined with deep seismic sounding. The classification and interpretation of recorded elastic waves solely on the basis of kinematic criteria is difficult. It is far more reliable to do this by using dynamic criteria -- amplitudes. The waves of greatest interest constitute a group of relatively intense elastic waves observed for periods of 6 to 10 sec whose apparent velocities change from close to infinity near the point of the shot to 8-12 km/sec when the distance is increased to 25-40 km. This indicates that they are reflected waves. A quantitative interpretation of depth to the surface of the "layered" stratum is estimated at 16.5 km and depth to the bottom is 32 km. By analogy with other regions the first boundary can be identified with the Conrad discontinuity (basalt layer). No reliable determination of the Mohorovicic discontinuity could be made.

8. "The First Results of Observations in the Tien Shan With a Horizontal Extensometer", by L. A. Latynina and R. M. Karmaleyeva, Institute of Physics of the Earth, pp. 1574-1578.

This article gives a description of the apparatus and first results of observations of deformations of the earth's surface by use of two quartz extensometers at Talgara (near Alma-Ata). The pattern of deformations is given for an 8-month period. The data obtained from the long-base component was used for making a harmonic analysis of

tidal deformations. This made it possible to determine the earth's elastic constants h and l.

9. "Induction-Type Magnetic Detectors for Investigation of the Earth's Magnetic Field", by N. P. Vladimirov, Institute of Physics of the Earth, pp. 1645-1650.

The text describes the design of induction-type magnetic detectors developed at the Institute of Physics of the Earth and the methods for using them in the field. However, they are ill-suited for practical use at this time because they are large in size, weigh 50 kg when packed and they are exceptionally sensitive to moisture and wind-induced microseisms. They do give good results in an investigation of the structure of the electromagnetic field in the 0.1-100 cps range. The results establish the practical feasibility of producing portable highly sensitive detectors with cores of relatively small diameter and induction winding of finer wire (the detectors developed at the Institute have 100,000 to 350,000 turns).

10. "Magnetotelluric Sounding in Central Turkmenia", by G. N. Anishchenko, V. V. Golubkov, K. I. Nikitenko and G. A. Chernyavskiy, All-Union Scientific Research Institute of Geophysical Method of Exploration, pp. 1651-1658.

This article describes magnetotelluric observations made in Central Turkmenia along a 400-km profile between Ashkhabad and Tashauz. It is accompanied by magnetotelluric sounding curves and the results of their geological interpretation. Fig. 5 shows a comparison of the results of a) magnetotelluric sounding, b) seismic exploration and c) drilling. It is demonstrated that at the present stage of development of this method it can be used in the complex of geophysical research methods for areas where the thickness of sediments is great. However, it is necessary to develop special apparatus for recording variations of the natural electromagnetic field in a wide spectrum of frequencies and to develop more reliable methods for processing the records.

Structure of the Earth's Crust in Northeastern Siberia

There is very little data available on the structure of the earth's crust in the northeastern part of the USSR. The author has drawn on the existing literature, which he briefly reviews, and compiled a map and cross section of the earth's crust for an area roughly east of a line drawn from the mouth of the Lena River to Okhotsk on the Sea of Okhotsk. The earth's crust in this area is of a typical platform structure. The approximate depths of the "basalt" layer and the Mohorovicic discontinuity have been determined.
(Abstract: "Structure of the Earth's Crust in the Northeastern SSSR as Revealed by Geophysical Data" by K. K. Shaposhnikov, Yakutian Branch, Siberian Division, Academy of Sciences; Novosibirsk, Geologiya i Geofizika, No. 9, 1962, pp. 100-105)

V. UPPER ATMOSPHERE AND SPACE RESEARCH

News

Launching of Spaceship to the Moon

The ship used for flight to the moon and return to the earth would weigh 50 to 100 tons. Such ships could be launched by giant rockets, 100 m high and weighing several thousand tons. Or relatively small rockets could be used for orbiting rocket components to be assembled in orbit. Another fuel-laden rocket would then be orbited and coupled to the assembled spacecraft.

A giant rocket would be more reliable than the alternative of assembling a rocket in space, but the expense would be enormous. It would require a hundred tank cars of fuel. Launching apparatus would cost a billion rubles. During this decade it will be infeasible to launch large rockets from the water, as some have proposed. It would be extraordinarily difficult to deliver a giant rocket to the launching pad -- the only feasible means being by barge and floats. However, it would be difficult to load such a huge rocket abroad a barge. Assembly in the field would lower reliability.

Several variants of space assembly -- in both earth and lunar orbits -- and on the moon itself -- are suggested; assembly in an earth satellite orbit is regarded as the most practical.
(Abstract: "'Mastodon' or Meeting in Orbit", by Yuriy Marinin; Baku, Bakinskiy Rabochiy, 26 July 1962, p. 4)

Long-Range US and Soviet Space Flights Contrasted

The American spacecraft "Mariner-II" and the Soviet station "Mars-1" and their possible impact on space exploration are discussed.

The "Mariner-II" could not carry heavy photographic equipment, even if it were possible to photograph the surface of Venus. The total scientific payload was only 18 kg. American rocket-carriers are inadequate to permit a Venus shot with a payload greater than 200 kg (the author explains the distribution of the other 182 kg).

The trajectory of the "Mars-1" can be corrected as much as 500,000 km; the possible correction of the "Mariner" is up to 800,000 km. The initial error in the "Mars-1" trajectory was 261,000 km; for the "Mariner" it was 375,000 km. The Soviet station should pass within 16,000 km of its destination.

The inclusion of chemical batteries to supplement the solar batteries is explained; its primary justification is to supply extra power at the moment when the station passes by the planet. The weight of the Soviet space station is almost 4½ times greater than the weight of the "Mariner."
(Abstract: "Course to the Planets", by Yuriy Marinin; Leningrad, Leningradskaya Pravda, 27 November 1962, p. 8.

Latvian Satellite Tracking Station

Three photographs of a Latvian satellite and rocket tracking station have appeared recently. They show the antenna of the station's radio telescope, a worker at the 550-mm reflector and an automatic electronic device for measuring and computing satellite coordinates from megatives. The large radio telescope, with a total antenna area of over 300 m^2, is used for daily recording of solar radiation on the 1½-m band. This apparatus was constructed by Latvians. The station also has optical telescopes for stellar observations.

A station for the reception of radio signals from artificial satellites and rockets has been built and a special camera for photographing these objects has been constructed under the supervision of Uldis Dzervitis. Maris Abele and Kazimir Lapushka, designers attached to the station, have developed special shutters for obtaining precise positions of artificial satellites on photographs. All stations in the USSR using the photographic method for the tracking of satellites and rockets are now equipped with these shutters.
(Abstract: "Space Over Latvia", unsigned; Riga, Sovetskaya Latviya, 1 November 1962, p. 1)

One Opinion on the Formation and Characteristics of Mars

K. Z. Starikov, Docent of Physical Geography at Kazakh State University, predicts that the "Mars-1" will confirm the existence of a Martian magnetic field. He feels that magnetism is caused by the rotation of a planet containing an iron-nickel core in a stream of particles emitted by the sun. This is why nonrotating bodies such as the moon and Mercury are virtually without magnetic fields. The magnetism of Mars should be 5 to 10 times less than that of the earth because of its greater distance from the sun and the thinness of its atmosphere. Starikov feels that the sun and planets originated from a single rotating dust nebula. The heavier elements, such as iron and nickel, were located near the center of this nebula. Therefore the small but dense planets of the earth group were formed near the sun. The first particles to be joined together were those possessing magnetic properties.

The "Mars-1" should discover meteor-caused craters such as those on the moon. Indeed, the earth's moon was once an independent planet and owes its craters to passage through the zone occupied by the asteroids.

Konstantin Zakharovich Starikov has devoted almost 20 years to developing his hypothesis. He states that the law of universal gravitation in Newton's formula is only correct when the distance between mutually attracting bodies does not change; otherwise corrections must be introduced which are dependent on the velocity and direction of relative motion of the bodies.
(Abstract: "What Will the 'Mars-1' See?", by M. Fel'd; Alma-Ata, Kazakhstanskaya Pravda, 15 November 1962, p. 4)

New Institute of Space Studies and Aeronomy

The Presidium of the Academy of Sciences has decreed that the Yakutian Branch of the Siberian Division of the Academy of Sciences at Yakutsk shall have an Institute of Cosmophysical Research and Aeronomy. It is to be based on the Laboratory of Physical Problems and subdivisions of the Branch's Geophysical Observatory.

The principal aspects of the scientific activity of the Institute have been defined. Its work will include cosmic ray variations; extensive atmospheric showers; stratospheric, extra-atmospheric and ionospheric studies; auroral investigations; geomagnetism; earth currents; and atmospheric physics.

The Institute will have seven laboratories and a section on theoretical studies with a computing office. The Institute will also include the "Tiksi" Polar Laboratory for Complex Geophysical Studies, the "Zhigansk" Laboratory of Magnetic and Ionospheric Studies and an artificial earth satellite observation station.
(Abstract: "Concerning Scientific Institutes of the Siberian Division", unsigned; Moscow, Vestnik Akademii Nauk SSSR, No. 11, 1962, pp. 127-128)

Reasons for Launching Spacecraft From Satellites

The "Mars-1" was launched from an artificial earth satellite, as was proposed by K. E. Tsiolkovskiy. Under these conditions a space vehicle can be launched in a nearly horizontal plane, thereby minimizing fuel consumption, making a greater payload possible, and increasing the accuracy of the trajectory. On a flight to Mars an error in velocity of 1 m/sec will result in a miss of more than 100,000 km; an error in direction of $1/10^{\circ}$ -- a miss of almost 500,000 km; and an error in launching time of one minute -- almost 150,000 km. When the launching is from a satellite which is moving at about 8 km/sec, the additional acceleration which needs to be imparted to a launched vehicle is only 3 to 4 km/sec. Rather than having a fixed surface launching it is possible to launch a ship from any point on the satellite orbit.
(Abstract: "Launching From Orbit", by N. Varvarov; Moscow, Vechernyaya Moskva, 13 November 1962, p. 2)

Benefits of Space Exploration

A recent feature article in the Soviet press reviews the scientific and practical benefits to be derived from space exploration. Such articles are common, apparently intended to maintain public interest in the costly national space effort. It is pointed out that it is difficult to derive proper scientific deductions concerning the earth without comparing it with other planets. Comparison with other planets will permit deductions concerning the formation of rocks and minerals, provide an insight into the earth's past and future, and shed much light on the origin of life. If life exists on other planets it should be substantially different than life on earth. If there are plants on the other planets which are adapted to the severe conditions prevailing there it is possible that they could be crossed with terrestrial plants to produce varieties resistant to cold and drought.
(Abstract: "Horizons of the Earth and Space", by V. Arsent'yev, State Astronomical Institute; Moscow, Sovetskaya Rossiya, 10 November 1962, p. 3)

"Mars-1" Flight Discussed

The article cited below is a general discussion of the flight of the "Mars-1" interplanetary station, the excellence of its systems and the difficulties involved in its launching; it contributes nothing to earlier published reports.
(Abstract: "Greetings Mars!", by A. Voskoboynikov, Tashkent Astronomical Observatory; Tashkent, Pravda Vostoka, 13 November 1962, p. 4)

Photographs Taken of "Mars-1"

Photograhs have been taken of the interplanetary station "Mars-1" and its rocket-carrier. The photographs were taken in November at the Crimean Astrophysical Observatory by Andrey Borisovich Severnyy, Corresponding Member of the Academy of Sciences, and Candidate of Physical and Mathematical Sciences Aleksandr Alekseyevich Boyarchuk. At this time the station had a brightness equivalent to a star of the 14th magnitude. The photographs were taken with the large mirror telescope im. Academician Shayn. A movie camera was used to take photographs with an exposure of several seconds. The same part of the sky was photographed twice on the same frame without moving the film. The stars did not move, but the station did. The observers were so sure of the position of the station that a single photograph would have sufficied, but 350 frames were taken. This is said to be the first such event in the history of astronomy (the Soviet "artificial comet" was 10,000 times brighter). The photos were all developed and dried by dawn. Every star on the photographs had to be positively identified. The coordinates of the station were determined by Leonid Semenovich Galkin, Scientific Secretary of the Observatory; he used a

special telescope with a considerably larger field of view to photograph the same sector of the sky in which the station was discovered. The positions of the stars and station were computed with an accuracy to several microns using a universal measuring microscope.
(Abstract: "The Earth Tracks the 'Mars'", by Vanda Beletskaya; Moscow, Ogonek, No. 49, December 1962, pp. 6-7)

Pros and Cons of Martian Life Discussed

The article cited below is one of the numerous articles recently appearing in the Soviet press which discuss the characteristics of Mars and the possibility of life on that planet. In general, it briefly discusses opposing views concerning the most prominent controversies. The only conclusion drawn by the author is that vegetation is probably present in very simple form, accompanied by extremely simple forms of animal life. Highly developed life forms are impossible.
(Abstract: "The Secrets of Mars", by Prof. B. Vorontsov-Vel'yaminov, Moscow State University; Moscow, Trud, 15 November 1962, p. 3)

Further Speculation on Mars

Interior pressures in Mars are less than in the earth because of the lesser diameter of that planet; Mars therefore does not have a solid core. The Martian magnetic field is possibly considerably weaker than the earth's. Because the surface gravity is less, tectonic and volcanic forces and the impact of meteors should form high mountain ranges, plateaus and large craters, although such features have not been observed. The "Mars-1" is less likely to suffer meteor damage than a spacecraft flying toward the sun.
(Abstract: "What is Concealed in the Interior of Mars", by Prof. V. V. Fedynskiy; Tallin, Sovetskaya Estoniya, 13 November 1962, p. 3)

Conference on Cosmic Ray Research

The First All-Union Conference on the Cosmophysical Orientation of Cosmic Ray Research was held at Yakutsk during the period 23-30 August. L. I. Dorman divided all observed cosmic ray variations into three classes: 1) variations caused by atmospheric effects, 2) variations caused by a change of the earth's magnetic field, and 3) variations of an extraterrestrial origin. Study of type-3 variations makes it possible to obtain data on magnetic fields in interplanetary space and the flux of solar cosmic rays. There was a discussion of the problem of the influence on diurnal variations of cosmic rays of the magnetic cavity formed by the interaction of a corpuscular stream and the earth's magnetic dipole. It has been firmly established that diurnal variations are more sharply expressed when cosmic ray particles pass through a thin absorber.

A. P. Mamrukov, Chief of the Yakutsk Ionospheric Station, described the state of the ionosphere over Yakutsk.

The Yakutsk auroral study group has discovered low-frequency radio emission from auroras and the upper layers of the atmosphere and detected an auroral "shore effect."

Much attention was given to problems related to the origin of cosmic rays and the chemical composition of primary cosmic radiation. V. L. Ginzburg emphasized the importance of determining the electron component in cosmic rays. Bremsstrahlung of cosmic electrons is said to be responsible for all the noise of cosmic radio emission. If this is so, electrons and positrons should constitute approximately 1% in all cosmic rays. It would be of interest to study the electron component at the time of solar flares, when, as has now been established, the nuclei of different elements are generated.

S. I. Nikol'skiy devoted much attention to the spectrum of cosmic rays at superhigh energies (he reported on American research which has shown that the greater part of cosmic rays at energies greater than 10^{16} ev is of metagalactic origin). However, V. L. Ginzburg and S. I. Syrovatskiy feel that all arguments now indicate a galactic origin of cosmic rays. In particular, if the metagalaxy was filled with cosmic rays the flux of photons from it would be extraordinarily large; this is not observed experimentally.

D. D. Krasil'nikov cited experimental data on the spectrum of μ-mesons. The μ-meson spectrum was derived with great statistical accuracy to energies of 10^{13} ev.

Since stars in systems similar to our world emit neutrinos and stars of anti-worlds emit anti-neutrinos, B. M. Pontekorvo pointed out the possibility of detecting discrete sources of neutrinos and anti-neutrinos and distinguish worlds from anti-worlds, which cannot be done by optical methods. Ya. A. Smorodinskiy, discussing the relationship between neutrinos and cosmological problems, noted the immense importance of these particles in the evolution of the universe. (Abstract: "A New Direction in the Study of Cosmic Rays", by A. A. Pomanskiy; Moscow, Vestnik Akademii Nauk SSSR, No. 11, 1962, pp. 130-131)

Conference on Photographic Observations of Artificial Satellites

A conference on methods for making photographic observations of artificial earth satellites was held at Riga during the period 29 June-2 July. It was sponsored by the Astronomical Council, the Academy of Sciences of the Latvian SSR and Riga University. The intfoductory review was by A. G. Masevich. Coordinate systems were discussed by I. D. Zhongolovich; satellite use for navigation purposes was considered by I. P. Shpitzberg; a paper by A. M. Lozinskiy treated the possibility of increasing the accuracy of photographic observations.

More precise photographic observations may help in the solution of certain astronomical, geophysical and geodetic problems. There is

a need for speedy computation of the instantaneous orbital elements of satellites on the basis of observations for brief periods of time. Analysis of these elements will help to explain the effect exercised on the motion of satellites by such short-lived factors as chromospheric flares.

The TAFO-AL-75 automatic camera for observation of faint satellites was described. An electronic computer is apparently used for making automatic measurements of astronegatives and in the processing of the results. This experimental camera is in use at the Riga Optical Observation Station. The conference recommended the production of 10 to 12 such cameras. A need was expressed for establishing in the USSR a continuous around-the-clock transmission of precise time signals.

(Abstract: "Photographic Observations of Artificial Earth Satellites", by N. P. Yerpylev; Moscow, Vestnik Akademii Nauk SSSR, No. 11, 1962, pp. 129-130)

Yakutian Upper Atmosphere and Space Research

The Yakutian Scientific Research Base of the Academy of Sciences was established in 1947 and reorganized as a branch of the Academy in 1949. The organization includes Institutes of Geology and Cosmophysical Studies and Aeronomy, among others. The latter is the leading organization in Siberia for the study of auroras and cosmic rays. Yakutian physicists have used high-energy mesons, penetrating deep into the earth, for sounding conditions in an atmospheric layer at heights between 40 and 80 km. By knowing the variations in meson intensity recorded underground it is now possible to determine the temperature of the mesosphere and follow the changes occurring in it; this is important for weather forecasting. Study of the temperature effects in cosmic rays make it possible to introduce corrections into the readings of stratospheric meteorological instruments heated by the sun when carried aloft.

Yakutian physicists have investigated the time and space distribution of cosmic ray bursts associated with giant nuclear explosions on the sun. The study of the relationship between these phenomena and electromagnetic conditions in interplanetary space and processes in the earth's atmosphere indicate a radial structure of the interplanetary magnetic field with the sun at its center.

The Institute is studying the nature of strong increases in the intensity of cosmic rays at the time of flares for the purpose of predicting such flares.

Auroral studies began in 1957. The most important results include the detection of a simultaneous change in auroral glow at different stations throughout the USSR and determination of a dependence between the spatial distribution and behavior of auroras on the electric and possibly the magnetic properties of the underlying surface.

(Abstract: "Science in Soviet Yakutia", by I. S. Rozhkov, Corresponding Member, Academy of Sciences, USSR, Chairman of the Presidium of the Yakutian Branch, Siberian Division; Moscow, Vestnik Akademii Nauk SSSR, No. 11, 1962, pp. 70-73)

Comments on Space Radio Electronics

Instruments using germanium and silicon semiconductors are used to a great extent in Soviet artificial satellites and spaceships. The third Soviet artificial satellite carried more than 4,000 instruments employing semiconductors. All radio receivers on the "Vostok" spaceships employed semiconductors; their normal lifetime is 100,000 hours. However, there already are instruments employing "super-pure" conductors which are capable of operating continuously for a million hours. The use of semiconductors and printed circuits have made possible the development of microinstruments in which 50 to 60 radio parts fit into a cubic centimeter; as many as 2,500 parts have already been assembled in a volume of that size. Work is proceeding on utilization of radio waves in the infrared, light and ultraviolet range. Plans also call for the use of gamma- and X-rays. Quantum generators (lasers) were recently used in making lunar observations; the beam was so narrowed that the diameter of the spot on the moon was only 3 km. The transmitter was 0.05 watt. In the future, possibly by the year 2000, there may be "universal communication" -- with each person in the world being able to communicate directly with any other person in any other region of the world.
(Abstract: "Space and Radio Electronics", by T. Aminov, Chief Engineer, Alma-Ata Directorate of Radio Communications and Broadcasting; Alma-Ata, Kazakhstanskaya Pravda, 4 October 1962, p. 3)

Notes on Future Space Developments

A day is visualized when tourists will make weekend space flights. The time is near when rocketships will be used for communication between the continents; flight time between Moscow and Washington will be reduced to 18 minutes. There should be no restrictions on women making space flights because they are physiologically equal to men. Soviet cosmonauts, in addition to their rigorous specialized training, are at the same time studying at the Air Force Engineering Academy im N. Ye. Zhukovskiy.
(Abstract: "From the Storm of Winter to the Storming of Space", by Ye. Petrov, Leader of the Group of Soviet Cosmonauts; Kiev, Pravda Ukrainy, 6 November 1962, p. 2)

Multiflight Spaceships

Piloted and unpiloted spaceships are foreseen which will make repeated interplanetary flights between space stations. The problem

of multiple use of rocket-carriers must be solved. The rocket-carrier stages to be saved will probably have retro-rockets. These rockets to be recovered will probably have wings to take advantage of aerodynamic forces to ensure braking and a smooth landing. It may be that the returning stages will not themselves have wings but instead will descend to earth on a special inflatable sail-like wing to which the rocket is attached by lines.

Future spaceships will not take off from or land on the earth's surface but will instead leave from cosmoports situtated at about 100 km above the earth. Rocket-taxis will shuttle from the earth to the cosmoports. Moreover, future space rockets will be different -- essentially in that they will have electric rocket engines rather than operating on liquid or solid fuel. These ion or plasma engines will be used in space but cannot be used for a launching from the earth's surface.

(Abstract: "Multiflight Spaceships", by Karl Gil'zin; Tashkent, Pravda Vostoka, 18 July 1962, p. 3)

Soviet Spaceship Air Conditioning Described

Soviet spaceships have an automatic air conditioning system. Sensing elements detect deviations from the proper cabin content of oxygen, carbon dioxide and water vapor. A signal is sent to a regulator which controls the regeneration rate. Considerable experience along these lines in the submarine fleet was helpful in devising these systems. In submarines, however, there are convectional processes which are absent in a spaceship where there is no convection under conditions of weightlessness. Circulation must therefore be induced by an electrically driven fan. Algae, especially chlorella, will be useful on long flights in the future for regenerating the air. Chlorella also can be used as food.

(Abstract: "The Atmosphere of a Spaceship", by Yuriy Ivanov; Tbilisi, Zarya Vostoka, 18 August 1962, p. 1)

A Review of Soviet Space Electronics

The article cited below is a review of Soviet space electronics. It is noted that it is still necessary to solve the problem of transmitting radio and television signals over distances of hundreds of millions of kilometers. The use of sources of thermonuclear energy will make it possible to greatly increase the power of radio transmitters. The use of quantum-mechancial amplifiers also will greatly improve the sensitivity of radio-signal receivers. Light waves generated by quantum generators (lasers) may be used for space communications. This will make it unnecessary to have large power sources for transmitters because they will be powered directly by solar energy. Gamma- and X-rays offer still greater possibilities for space communications.

(Abstract: "Radio Electronics -- the Nerves of a Spaceship", by Konstantin Palatov; Yerevan, Kommunist, 31 August 1962, p. 4)

Radio Communication in Space

"Vostok-3" and "Vostok-4" were tracked by both short and ultrashort radio waves. The network of transmitting and receiving stations in different parts of the USSR was connected to a special center where all data were collected; instructions were dispatched to the various stations from this same center.

The distance between the two spaceships was only 5 km; at spaceship velocities this distance can be covered in less than 1 second. The group flight was therefore a significant step toward the creation of inhabited stations constructed directly in space.

Present-day radio electronics makes it possible to communicate over distances of more than a hundred million kilometers, but quantum radio electronics will extend this range greatly. Quantum generators will concentrate light and infrared waves into extraordinarily narrow beams. In time relay stations will also be established on artificial bodies in space and on the planets.

(Abstract: "Radio Communication, Cybernetics and Interplanetary Trajectories", by V. Siforov, Corresponding Member, Academy of Sciences; Moscow, Trud, 4 October 1962, p. 3)

Possibilities of "Solar Sail" Described

The "solar sail" offers possibilities for effective space flight. The motive force would be the solar wind; the only difference from the principle of the photon engine is that natural radiation is employed. (It is mentioned in passing that the existence of a solar wind was demonstrated experimentally by P. N. Lebedev in 1899.). The solar sail is visualized as a very thin plastic film of very great area covered by an extremely thin layer of reflecting material such as aluminum. The sail would be connected to a spacecraft by cables. It is assumed that the acceleration imparted by the solar wind would be of the same order as the acceleration imparted by an ion or plasma engine. The effectiveness of the sail would naturally decrease with increasing distance from the sun. The solar sailship could not be launched from the earth and would be useless in the earth's shadow. The solar wind can be used for motion toward the sun as well as away from it; it could move on a spiral trajectory toward the center of the solar system.

When approaching a planet the spaceship sail would be manipulated in order to descend for assuming an artificial satellite orbit. Such a maneuver would probably require several weeks. It has the advantage of requiring no fuel or engine.

(Abstract: "Using a Solar Sail", by V. Levantovskiy; Moscow, Sovetskaya Rossiya, 13 October 1962, p. 4)

Abstracts of Scientific Articles

Scattered Sky Radiation at Heights of 15 to 17 Km

An automatic spectrometer with and without a diffraction grating was balloon-lifted to heights of 15 to 17 km near Tashkent in the autumn of 1961 for measuring the brightness characteristics of the sky. Data were transmitted from the balloon to the receiving station. Measurements were made in four parts of the spectrum corresponding to water vapor absorption bands with centers at 1.38 and 2.6 μ and the 1.23 and 2.2 μ transparency windows. The spectral width of the slit was 0.084 μ). Fig. 1 shows the relative change of brightness with height in the 1.23- and 2.2- μ transparency windows. There was a sharp decrease in brightness with height to the 6-7 km level, above which the change is very poorly expressed. The absorption bands show a small increase in brightness from the earth's surface to approximately 5 km, relative constancy to the tropopause, and then a gradual decrease in brightness; this is characteristic when scattering angles are not too small.

In the absorption bands the brightness depends on two factors operating in opposite directions. On the one hand there is a decrease in the number of scattering particles, and on the other hand there is a decrease in the amount of water vapor.
(Abstract: "The Measurement of Scattered Sky Radiation in the 1-3.5 μ Range at Heights of 15 to 17 Km", by Ye. D. Sholokhova and Ye. O. Fedorova, State Optical Institute im S. I. Vavilov; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No. 11, 1962, pp. 1671-1672)

IZMIR Short-Range Radio Forecasting Methods Described

The abstract of the article, "Method of Predicting Ionosphere Magnetic Disturbances and the Short-Range Radio Forecasting Service of IZMIRAN," by L. N. Lyakhova, (Trudy Instituta Zemnogo Magnetizma Ionosfery i Rasprostraneniya Radiovoln AN SSSR, No. 19 (29), 1961, pp. 3-17) reports that the principles are established for the modern methods of short-range radio forecasting at IZMIRAN and the possible future development of the method is considered. A description is given of those magnetic ionospheric disturbances which make long-range forecasting of radio conditions very difficult and inaccurate. The successful short-range forecasting of radio conditions requires a thorough study of helio-geophysical relationships, active processes on the sun and processes within the active regions of the sun. The characteristics of the magnetic field and the ionosphere are classified according to magnetic activity in a 3-class or 10-class system. (Referativnyy Zhurnal - Avtomatika i Radioelektronika, No. 9, 1962, Abstract 9-7-58 i)

IZMIR Work on Optimum Communication Link Frequencies

An abstract states that the article by V. N. Novysh-Bylinskaya, titled "The Examination of Certain Methods of Computing the Maximum Usable Frequencies of Communications Links on the Basis of Experimental Data", which appeared in Trudy Instituta Zemnogo Magnetizma Ionosfery i Rasprostraneniya Radiovoln AN SSSR, No. 19 (29) 1961, pp. 71-84, estimates the accuracy of the calculations of the maximum usable frequencies by the method of "control points," used by the Institute of Terrestrial Magnetism, Ionosphere and Radiowave Propagation, Academy of Sciences USSR, and the method of "equal steps," used by the Moscow Directorate of Radio Communications and Radio Broadcasting (MDRSV). The foreign literature was also surveyed, along with the archives of the MDRSV. The analysis indicated that both methods require further development for computing communication links with one or more than one point of reflection. Those links discussed are: Washington to Berlin (6,600 km), Washington - Resolute Bay (4,100 km), and other links ranging from 700 to 3,000 kilometers. The Moscow-Irkutsk (4,200 km) and Moscow-Vladivostok (6,400 km) links were examined on the basis of MDRSV data. The results obtained were for communications within the latitude belt of 40-65° N and primarily for the period of solar activity 1957-1958. (Referativnyy Zhurnal - Avtomatika i Radioelektronika, No. 9, 1962, Abstract 9-7-56 g)

IZMIR Work on F_2 Layer Forecasts

The article "Monthly Forecast of the Maximum Useable Frequency of the F_2 Layer in the Form of a World Chart Based on Moscow Standard Time", by V. F. Belugin (Trudy Instituta Zemnogo Magentizma Ionosfery i Rasprostraneniya Radiovoln, AN SSSR, No. 19 (29), 1961, pp. 140-150), according to the abstract, shows how the determination of operating frequencies in radio communications depends on forecasts of the maximum usable frequencies of the F_2, F_1, and E layers of the ionosphere, the predictions for the F_2 layer being of primary importance. The discussion includes ways of increasing the accuracy of forecasts, making the maximum usable frequency forecasts easier to use, reducing work expenditure in compiling forecasts, and two ways in which the maximum usable frequency forecasts can be compiled for the F_2 layer: 1) as a chart for a particular zone, and 2) as a world chart based on Moscow Standard Time or Greenwich Time. The forecast of the Institute of Terrestrial Magnetism, Ionosphere and Radiowave Propagation is shown to be the most reliable. (Referativnyy Zhurnal - Avtomatika i Radioelektronika, No. 9, 1962, Abstract No. 9-7-55 f)

Ionosphere Studies of the Institute of Terrestrial Magnetism, Ionosphere and Radiowave Propagation

The article, "Chromospheric Flares and Cosmic Radiation at a

Frequency of 28.5 Megacycles", by Ye. Ye. Goncharova (Trudy Instituta Zemnogo Magnetizma Ionosfery i Rasprostraneniya Radiovoln, AN SSSR, No. 19 (29) 1961, pp. 44-47), states that cosmic radiation passing through the ionosphere during periods of sudden ionospheric disturbances undergoes an anomalous absorption resulting from the increased density of the lower layers of the ionosphere, caused by the additional ultraviolet radiation of the sun at the time of a chromospheric flare. Recordings of the intensity of the cosmic radiation at a frequency of 28.5 megacycles were begun in January 1959 by the Department of Ionospheric Studies, Institute of Terrestrial Magnetism, Ionosphere and Radiowave Propagation, using an apparatus designed by G. V. Vasil'yev. On the basis of data dompiled in the period March-July 1959, the anomalous increase of cosmic radiation at 28.5 kilocycles was compared with various manifestations of solar activity and with sudden ionospheric disturbances. The anomalies dependent on the absorption of cosmic radiation are used as examples. The increase of cosmic radiation absorption at the time of chromospheric flares is plotted graphically. The intensity of the cosmic radiation field was recorded with a specially adapted AR-88 receiver, together with an N-370 automatic recorder. A five-element Yagi antenna, directed toward Polaris, was used. The cosmic radiation recorder provides satisfactory reliable recordings of flares of importance 2 and above, which means it is possible to forecast magnetic-ionospheric disturbances. (Referativnyy Zhurnal - Avtomatika i Radioelektronika, No. 9, 1962, Abstract No. 9-7-47 b)

The E_s Layer and Its Effect on Radio Wave Propagation

According to an abstract, the article of T. S. Kerolay, "The Regularities of the E_s Layer and Their Use in Radio Prognosis", which appeared in No. 19 (29), 1961 pp. 96-112 of the Trudy Instituta Zemnogo Magnetizma Ionosfery i Rasprostraneniya Radiovoln, AN SSSR, discusses the E_s layer as a manifestation of a number of ionospheric formations which differ in nature, physical properties, and their effect on radiowave propagation. A description is given of the regularities of the E_s layer which are a necessary basis for forecasting the maximum usable frequency for radio communications utilizing the E_s layer. A description is also given of the peculiarities of the E_s layer which make it different from other layers, for example, its sporadic nature, its local nature, its semitransparency, the dependence of its maximum usable frequency factor on amplitude, and its ability to appear in different forms. Its daily and seasonal variation and its geographic distribution are discussed, and its variations within the 11-year solar cycle are also considered. It is concluded that in a year of maximum solar activity, conditions prevail which are favorable for the formation of an E_s layer with high usable frequencies, which, however, in a number of cases, are greatly reduced by an increase of absorption, resulting in a feedback of E_s characteristics with solar activity. Both

effects are important in computing the frequencies to be used. Equally as important as the daily and seasonal variations are the coefficients of reflection of various types of E_s layers, since they afford the possibility of making a quantitative estimate of the dependence of the E_s layer on technical parameters, maximum usable frequency, and energy losses within the E_s layer as a result of reflection from the F_2 layer. (Referativnyy Zhurnal - Avtomatika i Radioelektronika, No. 9, 1962, Abstract No. 9-7-48 ts)

More on IZMIR Radio-Link Studies

According to the abstract, the article, titled "A Comparison of the Minimum Usable Frequencies Computed by Various Methods, and Experimental Data", by Ye. M. Zhulina (Trudy Instituta Zemnogo Magnetizma Ionosfery i Rasprostraneniya Radiovoln AN SSSR, No. 19 (29), 1961, pp.116-130) gives the results of a comparison of computed and experimentally obtained minimum usable frequencies. It is shown that for all the radio links considered the method used by IZMIRAN gives better agreement with experimental data than the CR PL method used in the United States, although the accuracy of the minimum usable frequencies computed by the IZMIRAN method is not uniform for links of different lengths at different times. The conclusions drawn are based, however, on a comparison of very limited data, which were not sufficient for a determination of the accuracy of the examined methods for calculations in the case of arbitrary radio-link direction and intensity. (Referativnyy Zhurnal - Avtomatika i Radioelektronika, No. 9, 1962, 9-7-58 sh)

VI. MISCELLANEOUS

News

Summary of Eighth Antarctic Expedition

The Eighth Antarctic Expedition left Leningrad aboard the "Ob'" and "Estoniya" in November to prepare Antarctic stations for work during the International Year of the Quiet Sun. Comparison with IGY data for the period of maximum solar activity will yield invaluable results. The forthcoming effort will be somewhat more limited than was the IGY program. It will be concentrated on solar effects on the earth and interplanetary space: geomagnetism, auroras, nightglow, the ionosphere, solar activity, cosmic rays and space research.

At Mirnyy work will now include recording of cosmic ray intensity in the stratosphere and observation of the drift of small-scale inhomogeneities in the ionosphere. Only Mirnyy and Novolazarevskaya are now in operation, but Vostok will be reopened. At Vostok it is possible to observe low-energy particles -- the solar components of cosmic rays. Vostok observations will include meteorology, aerology, actinometry, the ionosphere, terrestrial magnetism, auroras and galciology; other observations will include cosmic rays, whistlers and galactic radio emission.

Molodezhnaya station in Enderby Land will also operate, but only hydrometeorological observations will be made, supplemented by seasonal geological and geographic work.

After delivery of its cargo, which includes IL-12, LI-2 and AN-6 aircraft, the "Ob'" will make studies in the zone of the Antarctic convergence between 100° and 0°E and make a survey along 20°E from Capetown to the Antarctic. The "Ob'" will leave the Antarctic in April 1963 with seasonal personnel; the "Estoniya" will transport the members of the Seventh Antarctic Expedition to the USSR in January.

The Eighth Expedition will have 200 members, not counting crew members; more than 100 will remain all winter (12 to 14 at Vostok and 5 at Molodezhnaya). Komsomol'skaya station will operate during the summer only, serviced by personnel from Mirnyy.
(Abstract: "Eighth Antarctic Expedition", by Hero of the Soviet Union Ye. Tolstikov; Tashkent, Pravda Vostoka, 11 November 1962, p. 4)

Expeditionary Work on Lake Ladoga

The research vessels "Konstantin Deryugin" and "Akademik Kurnakov" annually begin work on Lake Ladoga as soon as the ice has disappeared. The Deputy Chief of the Ladoga Expedition is K. A. Mokiyevskiy of the Limnology Laboratory of the State Committee on the Coordination of Scientific Research Work of the Council of Ministers of the Russian SSR. During the past year the vessels covered 9,000 miles in the period from May through October. Eight hundred stations were occupied, during which studies were made of the lake's hydrology, meteorology, hydrobiology, microbiology and hydrochemistry. Much of this data is of importance for the fishing industry. The expedition worked in close collaboration with the Northwestern Administration of the Hydrometeorological Service. Automatic current gauges are used and samples were analyzed by the luminescent method. The collected data are now being processed.
(Abstract: "On Lake Ladoga", unsigned; Leningrad, Leningradskaya Pravda, 1 December 1962, p. 4)

Seventh Antarctic Expedition Reviewed

A. G. Dralkin, Chief of the Seventh Antarctic Expedition, has summarized the high points of the Soviet work during the past year. The first studies of little-known Enderly Land were made; the geological detachment under Lev Klimov collected considerable data on its geological structure. It has been established that several "peninsulas" are actually islands, being connected to the mainland by masses of ice. A team headed by Prof. Viktor Buynitskiy and Vladimir Shamot'yev made oceanographic and hydrographic observations in the gulfs of Enderby Land. Novolazarevskaya became an observatory; seismological and earth current observations are now made, in addition to the study of cosmic rays and auroras. Mirnyy now has phototelegraphic apparatus which supply the whaling fleets with synoptic charts and detailed weather forecasts.
(Abstract: "The Sixth Continent Speaks", unsigned; Leningrad, Leningradskaya Pravda, 1 December 1962, p. 4)

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